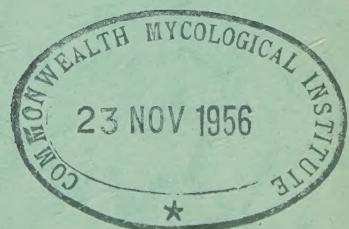


1954 REPORT
ON THE WORK OF
THE DEPARTMENT OF AGRICULTURE



SIERRA LEONE

Price—THREE SHILLINGS AND SIXPENCE



1954 REPORT
ON THE WORK OF
THE DEPARTMENT OF AGRICULTURE



SIERRA LEONE

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D. Watson, C.D.A.

REPORT OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1954

SECTION I—INTRODUCTION AND POLICY

The staff position improved with the arrival of four new Agricultural Officers, one Mechanical Officer, one Agricultural Superintendent (Mechanical) and one Field Officer during the year. Two senior members of the staff left: one on transfer to another Colony and the other on retirement. The field staff was fully extended and the need for additional staff to keep pace with agricultural development continued to be felt. Work continued on the fitting up of the laboratories at the West African Rice Research Station at Rokupr and it is hoped that this will be completed by 1955.

2. Eight Sierra Leone members of the staff continued their studies in the United Kingdom. Two completed the one-year course at Nottingham Farm Institute and two others started the same course.

3. Development continued on the lines started in previous years and included the mechanical cultivation of riverain swamps in the South and boli-land swamps in the North for rice, the distribution of fertilizers, the planting of improved oil palm seedlings and the multiplication of pig and poultry breeding stock. The settlement of Fula cattle owners, work on the fermentation of cocoa and investigations into the possibility of using waste *Lophira* bush areas were also continued. The distribution of planting materials including seed rice was increased, and hatching eggs, young fowls and pigs were available in greater numbers. Importations of day-old chicks by air to augment existing stocks were again made.

4. The wet season once more started earlier than normal, which seriously affected upland farms. This, coupled with the migration of labour to illicit diamond areas, resulted in a considerable reduction in the production of upland rice and some export crops. Yields of rice from swamp areas however were very satisfactory. It was a poor year for groundnuts, only 1,142 tons were exported compared with 2,686 tons in the previous years. Palm kernel exports declined by some 900 tons, benniseed by some 400 tons and ginger by some 700 tons. Other produce notably coffee and piassava more than compensated for these deficiencies, and total exports amounted to 82,685 tons worth £6,088,858 against 80,978 tons worth £5,714,554 in 1953.

5. There was a further large increase in the acreage of land cultivated by mechanical means and an encouraging increase in the use of superphosphate was recorded, notably on rice in boli-land areas. With the continued drift of labour away from the land the need for increasing the output per man of those remaining has been intensified. The use of tractors and fertilizers, particularly in connection with rice cultivation, is an important means to this end.

6. On the livestock side the numbers of breeding stock have been increased, settlement of nomadic cattle owners has continued and likewise a cattle-fattening scheme run by a District Council in the southern grasslands.

7. The high price of coffee and cocoa has maintained interest in the establishment of new plantations. Particular interest was shown in coffee and establishment of plantations continues to increase everywhere even in the northern districts. The attraction of these two crops combined with that of illicit diamond mining is having an adverse effect on palm kernel production; nevertheless the demand for improved oil palm seedlings was maintained. So long as swamp rice production can be increased the development of permanent crops on the uplands is the inevitable corollary to the policy of the Department over the last twenty-six

years or more. The mechanisation of swamp rice cultivation and the use of fertilizers must increase at a rapid rate if local food production is to be commensurate with the production of export crops and industrial development.

8. Whether or not this race with time will be successful depends in the end upon the farmers' ability to adapt themselves to modern techniques and to take advantage of them. There are encouraging signs that they will, but owing to the traditional conservatism of farmers—a universal trait not peculiar to this territory—they may be a little late in catching up; moreover they have much to learn. It is a far cry from the traditional cutlass and hoe to the modern crawler tractor and plough, particularly when one considers that the intermediate step of animal-drawn implements is missing. In the livestock field the prospect is much the same. Fowls are familiar to everyone, cattle are a feature of the North and in recent years pigs have come to the fore in some areas. Modern methods of management are essential in order to put the production of livestock on a sound basis. The best results cannot be expected from domestic animals that are left to forage for themselves, they must be properly fed and cared for if increased production is to be achieved. The Department is doing everything possible to bring Sierra Leone farming methods up to date by example and by demonstration not only in agricultural stations but in the field, with the goodwill and co-operation of the farmer on his own farm.

A—THE PROVISION OF ADEQUATE FOOD FOR THE PEOPLE

9. The principal means whereby this may be achieved is by encouraging the improvement and spread of swamp rice cultivation to the greatest possible extent.

(i) *Mangrove Swamp Reclamation:*

10. The Mangrove Clearing Loan Scheme which was started by the Department in 1939 has now been replaced by District Council schemes. In Bonthe District mangrove has been felled and cleared by the District Council for renting out to interested farmers: by the end of 1954 some 400 acres had been felled and 141 acres cleared. In Moyamba District the Loan Scheme was taken over by the District Council but owing to lack of funds no loans were issued during the year. Good progress was made by unassisted farmers on the Ribbi River and 89 acres of mangrove were felled at Yeliba in the Port Loko District, also about 200 acres in the Kambiadi creek of the Scarcies Circle.

(ii) *Saline Swamp Development:*

11. No further work was undertaken on the empoldering of saline swamps, and the total area remains at 833 acres. As indicated in the 1953 Report areas such as those at Bakepet and Bambaia in the Scarcies Circle do not require empoldering so long as the drainage system is adequate, and this year the sluices were left permanently open so that tidal washing could take place at all times. In a similar area near Katema the farmers themselves have begun the reclamation of saline land by improving the drainage. Guidance was given by the Department, tools were loaned from Kambia District Council, but the people received no financial aid.

12. At Mapotolon, where empoldering is essential, farmers have shown increased confidence in the scheme and a much larger area was planted than in 1953.

(iii) *Inland Swamp Cultivation:*

13. The schemes initiated by the Department were completely handed over to District Councils or to the farmers themselves. In the Makeni Circle 307 acres were cleared between 1946 and 1953 and, under the new Swamp Clearance Bonus Scheme run by the District Councils, a further 236 acres were cleared in 1954, at a cost of about £2 5s. 0d. per acre.

14. The expansion of the cultivation of inland swamps has continued rapidly throughout the North and to a lesser degree in the South-east. In the Colony there has been a disappointing lack of interest and the cleared area near Campbell Town and Kotopema remained at 100 acres.

15. The value of the use of superphosphate for rice production on boli-lands and inland swamps was confirmed, and apart from fertilizer used on departmental experiments and trials over 17 tons were sold to local farmers.

16. Ox-ploughing continued in the North, mainly in the Mabole Valley and also on an increasing scale in Koinadugu, where the long narrow swamps are unsuited to mechanical cultivation. Since 1953 44 oxen and 21 ploughs have been distributed in Koinadugu District.

(iv) *Mechanical Cultivation of Swamps:*

17. The following table shows the progress made:—

<i>District</i>			<i>Acres Ploughed</i>					
			1949	1950	1951	1952	1953	1954
Bonthe	..	..	4	69	282	465	1,178	2,278
Scarcies (Kambia) ..	..	..	—	—	80	192	5	—
Port Loko	..	..	—	—	—	453	678	757
Pujehun	..	..	—	—	32	403	623	1,012
Moyamba	..	..	—	—	—	316	395	—
Makeni (Bombali) ..	..	..	—	—	—	238	607	1,600
Musaia (Koinadugu) ..	..	..	—	—	—	30	163	127
Makeni (Tonkolili) ..	..	..	—	—	—	—	308	849
Total	..	..	4	69	394	2,097	3,957	6,623

18. The area under mechanical cultivation was again increased. The site at Marthyn in the Moyamba District was abandoned because of difficulties in communication and high transport costs, and ploughing was stopped at Mangé in Kambia District, where difficulties of a sociological rather than a technical nature arose.

19. Elsewhere sites were expanded and new ones opened, so that despite the closing down of some sites a total of 6,623 acres were cultivated compared with 3,957 in 1953. Considering that the first large-scale operations were undertaken in 1952 when just over 2,000 acres were cultivated this represents a very creditable rate of expansion, which it is hoped to maintain in 1955.

20. Yields were good in most areas and there was little flood damage. Farmers on the whole were well pleased, harvesting crops of 1,500–1,800 lb. per acre of paddy in Bonthe District and up to 1,500 lb. in the boli-lands.

21. Technical difficulties have now been largely overcome and it has been possible to standardize equipment to a considerable degree. Nevertheless testing of new machinery continued. A grant of £94,500 from Colonial Development and Welfare Funds for surveys and trials on potential new rice land enabled considerable investigation work to be undertaken. Amongst the most interesting innovations was the trial of combine harvesters. Preliminary work indicates that these machines work well on the boli-lands but at present are economically unsound.

22. Mechanical cultivation has been shown to be technically feasible and must be continued if rice production is to be maintained in the expanding economy of the country. Efforts are now being concentrated on the investigation of the economics of the new farming techniques.

(v) *Swamp Seed Rice Distribution:*

23. The main source of pure seed continued to be the Rice Research Station at Rokupr. Some 747 bushels (44,820 lb.) were produced and supplied to stations or sold to farmers. In addition nearly 50 tons of seed rice of high quality was

sold to farmers. Most of this was grown on agricultural stations, Native Administration or District Council farms, but some was purchased from farmers who had grown pure seed.

(vi) *Better Cultivation of Inland Swamps for Crops other than Rice in the Dry Season and the Development of Small Field Crops:*

24. The Horticulturist continued to encourage the production of vegetables in the Colony area. A new sub-station was opened by this section in Kabala, where the prospect of growing vegetables is excellent. Help was given to market gardeners throughout the country by providing advice, seed and fertilizers.

25. Experiments on the utilisation of *Lophira* bush continued in Port Loko District but with very varying success so far. Ordinary applications of normal fertilizers give little response and experiments were initiated to determine whether the absence of a trace element may be the limiting factor.

26. The practice of using inland swamps to cultivate sweet potatoes, cassava and vegetables during the dry season continued to spread.

27. Banana production continued to expand but the export prospects are at present limited due to the variable quality of fruit supplied. This trade depends perhaps more than any other on the organisation of cutting, packing, transport and shipping and, until this is achieved, the establishment of a regular export of fruit is likely to remain uncertain.

(vii) *Improvement of Livestock and Poultry:*

28. *Cattle*.—The breeding of Ndama cattle for beef production continued at Musaia. The number of breeding cows increased to 130 so that stricter culling is now possible. In a preliminary selection of bulls in October, 24 were discarded. This means that the selection of suitable strains should proceed more rapidly than in the past. A scheme for fattening cattle on the riverain grasslands of Gbundapi in the Pujehun District was undertaken by the Pujehun District Council and, in spite of the loss of two animals from snakebite, a modest profit was made.

29. Improvements were made in the seventeen areas of the Koinadugu District for the settlement of nomadic cattle owners and fourteen of the areas were occupied. A further nineteen areas, each of one square mile, were registered for settlement and improvement in 1955.

30. *Pigs*.—Newton and Njala continued to be the main pig breeding stations. At Musaia it was decided to reduce the stock because of the poor local demand and the difficulty in providing feeding stuffs. At Newton and Njala new piggeries were built and, in spite of a heavy culling programme to upgrade the stock, numbers again increased and 101 head were sold to farmers for breeding purposes. The main difficulty experienced by all pig keepers has been the inadequate and seasonal fluctuations in the supply of local foodstuff.

31. *Small Livestock*.—Rabbits and guinea pigs have continued to do well, and it is proposed to expand this section and also to introduce new blood in 1955. Thirty rabbits were supplied to the Veterinary Department for the production of Rinderpest vaccine and twenty-seven were sold to local applicants for breeding purposes.

32. *Poultry*.—More Rhode Island Red chicks were imported from the United Kingdom and stocks, at all stations, were greatly increased. This, and even more important, the introduction of the deep litter system of poultry keeping has brought about a very large increase in egg production. Distribution to local farmers totalled 188 cocks and cockerels, 77 hens and pullets, 383 chicks and 5,510 hatching eggs. In addition some 23,572 eggs were culled and sold for table use.

33. *Chinese Geese*.—The birds continued to thrive but the hatchability of the eggs still continues to be a problem; 41 birds were sold for breeding.

34. *Ducks*.—The stocks of Muscovy ducks increased on all stations. This is undoubtedly the best breed for the country.

B—THE CULTIVATION OF CASH CROPS AND THE EXPLOITATION OF WILD TREES FOR EXPORT PURPOSES.

35. The following table gives comparative figures of agricultural exports in recent years:—

<i>Products</i>		1938	1951	1952	1953	1954
PALM KERNELS						
Quantity, tons	..	63,697	75,102	76,375	68,904	68,080
Value	..	£454,031	£4,549,777	£4,675,914	£4,259,539	£3,763,924
Price	..	£7	£61	£61	£61	£55
PALM OIL						
Quantity, tons	..	1,066	3,191	832	362	919
Value	..	£16,025	£260,844	£87,940	£26,873	£53,667
Price	..	£15	£81	£105	£74	£58
PIASSAVA						
Quantity, tons	..	3,791	6,153	3,546	2,646	5,693
Value	..	£40,369	£283,010	£138,671	£192,452	£334,210
Price	..	£10	£46	£39	£72	£59
GINGER						
Quantity, tons	..	2,705	3,251	1,515	1,859	1,143
Value	..	£60,680	£772,393	£169,629	£144,702	£162,206
Price	..	£22	£241	£111	£77	£141
COFFEE						
Quantity, tons	..	38	1	1	1,050	2,393
Value	..	£793	£216	£217	£333,014	£862,892
Price	..	£21	£218	£217	£317	£373
COCOA						
Quantity, tons	..	384	1,118	2,061	1,631	1,738
Value	..	£5,849	£525,974	£638,481	£452,923	£802,565
Price	..	£15	£290	£309	£270	£462
KOLA						
Quantity, tons	..	1,450	1,564	1,242	1,204	1,379
Value	..	£29,785	£181,979	£181,009	£136,385	£275,545
Price	..	£20	£116	£145	£113	£200
BENNISEED						
Quantity, tons	..	374	46	336	636	198
Value	..	£3,700	£3,073	£30,995	£45,666	£17,561
Price	..	£10	£67	£92	£71	£89
GROUNDNUTS						
Quantity, tons	..	Nil	3,619	2,168	2,686	1,142
Value	..	—	£189,414	£182,322	£153,000	£64,288
Price	..	—	£52	£84	£56	£56
Total Tonnage						
All Exports	..	73,505	94,738	88,076	80,978	82,685
Total Value						
All Exports	..	£614,232	£6,766,680	£6,105,178	£5,714,554	£6,336,858

NOTE.—Quantities are quoted in tons. Prices are the average ruling price per ton during each year. These figures are quoted from export statistics, the actual monetary value to the producer would be two-thirds of these figures.

36. The main changes in production were decreases in palm kernels, ginger, groundnuts and benniseed and increases in piassava, coffee and cacao. The decrease in palm kernels was again largely a result of the decrease in the farming population and this also applies to ginger and groundnuts. In the case of ginger the price was another factor, and, as price fluctuations have been very considerable in the past few years, the growing of ginger has been a very speculative business. In the case of groundnuts, whilst labour was an important factor, weather conditions were also unfavourable, also the shortage of rice led to a

greater quantity being consumed locally. The increase in piassava production was largely due to price increases in 1953, encouraging more retting in early 1954; the increases in cacao and coffee were due to good prices and to new plantations coming into production. Coffee, in particular, has greatly interested farmers in the past few years as prices have been high and little work has been necessary to obtain a saleable quality due to a world shortage.

37. Although the responsibility for raising and distributing improved varieties of oil palm seedlings has largely been handed over to District Councils, the Department has continued to supervise and advise on this subject, as well as continuing to run a few large central nurseries. Progress during the last five years is shown in the following table:—

Oil Palm Seedling Distribution

<i>Circle</i>	<i>Number of Seedlings Distributed to Farmers</i>				
	1950	1951	1952	1953	1954
Njala	6,277	4,716	16,738	15,644	6,009
S.W. Circle	8,604	21,600	50,565	62,215	64,300
Rokupr	783	3,115	9,629	600	3,317
Port Loko	7,775	12,118	5,772	3,523	12,124
Makeni	12,053	25,675	43,396	48,744	30,586
Kenema	—	1,190	4,900	11,515	19,561
Colony	4,000	12,600	14,500	3,300	12,935
Bonthe	—	—	615	2,790	1,898
Musaia	—	—	—	—	1,600
Total	39,492	81,014	146,115	148,331	152,330

38. Over half a million seedlings of improved varieties of oil palm have been distributed since the campaign began in 1948 and, although survival rates have not been as good as could have been wished, new planting techniques, recommended by the West African Institute for Oil Palm Research, have been adopted, and it is expected that, in future, the percentage mortality of young palms will be considerably less. In spite of the disappointing survival rates in some areas, the effect of the distribution of this large number of palms is beginning to be felt.

39. The replanting of the Masanki plantation was started by the Department for the Sierra Leone Produce Marketing Board and, during the year, 58,655 seedlings were interplanted between the present trees. This is part of a five-year programme for the complete replanting of Masanki. Replacements were made at the Waterloo plantation and survival rates have been very good. A further area will be planted in 1955.

40. The main centre for the raising of oil palms continued to be Njala and seed of improved varieties was again obtained from Nigeria. Nurseries were also maintained at other stations and by District Councils.

41. Farmers tended to concentrate their efforts on coffee rather than cocoa, as in 1955. However, the production of cocoa was satisfactory and there was a marked increase in quality. Farmers also paid more attention to simple control methods against Black Pod disease, which continued to cause a considerable loss of crop.

42. Two monkey drives were organised in the South-Western Province but these were not as successful as in past years as many of the young men had left their chiefdoms. Some 3,000 animals were killed, making a total of 118,700 killed in the South-Eastern and South-Western Circles since 1947.

43. One experimental cocoa fermentary was maintained at Futa, where work in 1954 was mainly directed towards confirming previous results. Active propaganda was continued on the correct methods of fermentation and the success of this, and previous work, is reflected in the considerable increase in the amount of Grade I cocoa produced. The seedlings of the Amazon varieties of cocoa, obtained from the Gold Coast in 1952, have made satisfactory progress.

C—SOIL CONSERVATION

44. Development of swamps and the mechanical cultivation of boli-lands and riverain grasslands continued to expand and afford some relief to the pressure of farming on the uplands. Early burning of the northern savannah areas continued in co-operation with the Administration, Forestry and Local Administration staff. The long-term effects of this policy are now becoming noticeable and there are definite indications of forest regeneration in areas where grass had in the past replaced forest.

45. On the seventeen areas in Koinadugu District, surveyed for settlement and improvement in 1953, dams and sluices were erected where necessary, and other improvements made. On fourteen of the areas Fula cattle owners had been settled. Nineteen new areas were surveyed for settlement and improvement in 1955.

D—THE IMPROVEMENT IN PREPARATION, QUALITY AND MARKETING OF PRODUCE

46. Instruction was given to farmers on the correct ways of preparing their produce for market. Only one of the departmental cocoa fermentaries continued in operation on an experimental basis, but the success of the methods evolved by the Department, and the extent to which its propaganda has been successful, is indicated by the fact that, in Kenema Circle, between 75 per cent and 80 per cent of the crop marketed in 1954 was Grade I. The quality of coffee gives cause for concern and, although the necessity for improvement has been stressed and correct methods of processing have been demonstrated, it is likely that a concentrated effort will have to be made, in the same way as was done for cocoa, before much improvement can be expected. The quality of piassava was, as usual, very variable; but, on the whole, better than in the past few years. Agricultural staff, piassava demonstrators and Co-operative Societies continued to give instruction, and, the latter in particular, were responsible for the production of much high-grade fibre.

E—AGRICULTURAL EDUCATION

47. At the Njala Training College the practice of students doing six months of practical work after their academic studies ceased; the more usual course, of having students doing field work before entry into the College, was adopted. Under this scheme, 21 students were recruited to fill 18 vacancies in the College in 1955. There were 24 students in residence of whom 10, including one from the Gambia, successfully completed the course. The remaining 14 students entered their second year.

48. Mr. W. C. O. Allen, Agricultural Instructor, was again seconded to Mabang Agricultural Academy.

49. Messrs. S. A. Kawa, R. A. Siaffa and H. O. Jarrett continued their studies at various United Kingdom Universities. Messrs. M. B. Alpha and S. A. Jabati completed their practical training in the United Kingdom and proceeded to Reading University to start their Agricultural Degree courses. Mr. C. T. Pyne obtained his diploma in Agricultural Science at Cambridge University and proceeded to Nottingham University to pursue an M.Sc. course in Mycology. Messrs. P. V. Sellu and A. Koroma, Agricultural Instructors, returned after a year's course in General Agriculture at the Nottinghamshire Farm Institute, and Instructors W. E. A. French and J. O. P. Davies proceeded to the United Kingdom to take a similar course.

F—RESEARCH

50. The laboratories of the West African Rice Research Station at Rokupr were completed, which allowed work to proceed much more rapidly. Details of the work carried out are given in the Annual Report of the Rice Research Station, published separately.

51. The establishment of a sub-station of the West African Institute for Oil Palm Research at Njala started, and Mr. R. W. C. Galt, Research Officer, arrived, on secondment from Nigeria, in August to take charge.

52. The Plant Pathologist continued his work on Sierra Leone fungi and plant diseases. Details are given under the appropriate section.

53. The Agricultural Chemist continued fertilizer experiments, including investigations on trace elements. Routine examinations of soils, also, were carried out. Details of the work are given later in this Report.

SECTION II—THE WORK OF THE DEPARTMENT OF AGRICULTURE

A—ORGANISATION AND STAFF

54. Organisation remained, substantially, as in 1953. Mr. A. F. MacKenzie, Deputy Director of Agriculture, left in May to take up appointment as Director of Agriculture, British Guiana. The vacant post was filled, at the end of the year, by the appointment of Mr. T. N. Greeves, on transfer from Nigeria. Mr. E. I. Nisbett, Agricultural Officer, retired in July after 29 years service in the Department. Promotions included Messrs. R. M. Steven and E. H. Nichols to Senior Agricultural Officers with effect from January, 1954.

55. There were several arrivals to fill vacancies in the Agricultural Officer cadre. Messrs. D. C. MacKenzie, F. P. Massey and J. P. Scott, new appointments, arrived in August, and Mr. E. C. W. Dunham, new appointment, arrived in September.

56. Other new appointments were Mr. P. J. Rooksby, who arrived in February, Temporary Agricultural Superintendent (Mechanical), Mr. D. F. Howson, who arrived in November, Mechanical Officer, on agreement, and Mr. D. J. Watson, who arrived in December, Field Officer, on agreement.

57. Despite the new staff appointments, the expansion of extension work kept staff at full pressure. Nevertheless, the main programme was carried out successfully and several new and promising lines were developed. Much more, however, could be done with more trained Research and Field officers.

B—AGRICULTURAL CIRCLES

SOUTH-WESTERN CIRCLE

Experimental Station, Njala:

58. *Upland Grasses*.—Experiments with exotic grasses were discontinued as it was felt that the maximum useful information had already been obtained. The dwarf strains of *Panicum maximum* do not compete successfully with weeds, or inferior indigenous grasses, except with the most careful management and fertilizer treatment, and the life of swards of other species such as *Pennisetum setosum* and *Panicum maximum*, CPI 8389, is limited to about five years.

59. *Leguminous Fodders*.—*Pueraria phaseoloides* continued to be the most satisfactory fodder and reliance was placed on this crop for stock feeding. *Stylosanthes gracilis*, which was obtained from Nigeria in 1953, was multiplied for field trials.

60. *Other Annual Crops.*—Fertilizer trials were continued on various crops, confirming past experience that the upland soils of Njala are benefited by the addition of phosphates. In an experiment on cassava, the use of sulphate of potash enhanced the effect of superphosphate, when heavy dressings were applied. However, of a number of trials to determine whether any residual manurial effect occurred, all gave negative results. Fertilizer demonstration plots were continued and, apart from their value to visiting farmers, are proving a useful indicator experiment as the effect of the treatment becomes cumulative.

61. A further groundnut trial confirmed that early planting is essential for the best results. Thus, seed sown in early April gave 1,065 lb. of dry unshelled nuts per acre, while seed sown on 1st July failed completely. In an experiment comparing four different varieties of groundnuts, the Kono and Maris varieties proved superior to Temne and Sotina, under conditions prevailing at Njala.

62. The groundnut exhaustion trial continued, to find the effect on yields of continued cropping. This was the fourth year of the trial and a severe drop in yield occurred, following the unexpectedly high figure in 1953. Results to date are:

Year					Dry Weight/Acre (Uncorticated)
1951	..	..	..	..	974 lb.
1952	..	..	..	..	512 lb.
1953	..	..	..	..	711 lb.
1954	..	..	..	..	358 lb.

63. A trial comparing methods of planting cassava showed no statistically significant differences. Top and bottom cuttings were planted, both vertically and inclined, with and without fertilizer.

64. An experiment on yams showed that capping, with organic manure, alone gave superior results to the application of fertilizer alone but that a combination of both treatments gave the maximum response.

65. Intercropping of citrus orchards was continued successfully.

66. *Continuous Cultivation of Annual Crops.*—The method of mixed cropping introduced in 1952 was continued and extended. Briefly, this is a system whereby crops are rotated in space rather than in time. After deep cultivation, four foot ridges are planted with yams with placed fertilizer. Later, rice is sown and, after harvesting the rice, cowpeas, or other short-term leguminous crops, are sown with top dressings of superphosphate. Vacant plot spaces are planted with cassava. The ridges are split each year, so that any residual manures are thoroughly mixed in the soil.

67. This system, which seemed very promising at first, has not given consistent results. In part, the poor yield of yams in 1954 may be due to late planting, and the increased yield of rice to a change in variety.

68. The actual food value produced under the system can be calculated as the number of men who can be fed from one acre for one year, basing the calculation on a daily energy requirement of 3,000 calories. In spite of the increase in rice yields, this figure has declined, as can be seen from the table. The experiment will continue for several more years.

Year		Yield in Lb./Acre				Men Fed per Year
		Husk Rice	Cassava	Yams	Cowpeas	
1952	..	135	7,553	1,172	10	4.50
1953	..	120	5,033	3,346	—	3.96
1954	..	497	3,255	1,306	56	2.75

69. *Permanent Crops*.—The yields of citrus, coffee, kola and pineapples continued to be recorded. Yields of citrus increased on most blocks and fertilizer treatment was continued. Pineapple stocks were multiplied to meet future demand, which is increasing.

70. *Oil Palms*.—A third consignment of 100,000 seeds of improved varieties was obtained from the West African Institute for Oil Palm Research, Benin. The percentage germination of these was better than in the past. Seedlings were nursed and the overhead irrigation system proved very useful in producing strong healthy seedlings.

71. Some 36,509 seedlings were distributed from the Njala nursery during the year, including 29,000 to Masanki Plantation and 500 to Bonthe. At the end of the year approximately 44,000 were available in the nursery for planting in 1955. Maintenance and recording of the present blocks of improved palms continued.

72. *Livestock—Cattle*.—All draught oxen were culled as tractors replaced animal power, and this enabled economies to be made in labour. Manure production was maintained by the increased number of pigs. Health remained good throughout the year. One heifer calf died of snake bite, and a bull calf from apparent haemorrhagic septicaemia. As a precautionary measure all susceptible animals were inoculated against this disease. Routine inoculations against rinderpest were continued during the year.

73. *Pigs*.—A second piggery was completed during the year and the construction of a third unit commenced. Litters were heavily culled to upgrade the pure lines of Large White and Wessex Saddleback. Litter size of the latter breed was consistently low, which may be due to excessively close inbreeding. The cross between the two breeds proved a desirable commercial strain, and there was a considerable demand for cross gilts, in pig to Large White boars. In spite of the culling programme, and difficulties in obtaining feeding stuffs, the pig population was increased from 45 to 110. Health was extremely good. Only one sow was lost, due to general septicaemia, and her litter was successfully reared by hand.

74. *Poultry*.—Poultry production again suffered heavily through the incidence of disease, which was aggravated by the difficulties in providing a balanced diet. Day-old chicks imported from the United Kingdom suffered from curl toe paralysis—a condition associated with a deficiency of riboflavin. In addition 120 rearing stock succumbed to chicken pox, gapeworm and roundworm. The total stock rose from 104 adults and 149 chicks to 160 adults and 129 chicks. 100 hens were obtained from Newton, but they arrived too late to increase the egg production materially. These birds were kept on the deep litter system. Total egg production for the year was 3,147, of which 875 were incubated and 603 sold for hatching.

75. Although the position was improved, it is still not considered satisfactory. New buildings completed, or under construction, included an incubator room, brooder room and deep litter house. This building programme, together with the arrival of modern incubating and brooder equipment on order, should enable considerable advances to be made in 1955.

76. *Muscovy Ducks*.—The flock increased from 109 in 1953 to 175. The mortality of ducklings, which has always been high, was found to fall considerably by rearing young ducks away from their mothers. No distribution of eggs or breeding stock was made, as it is the aim to increase the breeding stock at Njala to at least 100.

77. *Chinese Geese*.—Results were most disappointing. Although the adult birds flourished, few eggs were produced and these were 80 per cent infertile. Ten adult birds were sold for breeding.

78. *Rabbits*.—Rabbits continued to do well and, by the end of the year, the stock totalled 79. Thirty were sent to the Veterinary Department for the production of lapinised virus serum and 27 were sold for breeding. Sixty-eight animals, mostly young, died from coccidiosis and pneumonia during the period when they were in temporary accommodation pending the completion of the new rabbitry. It is proposed that new stock be introduced from Europe in 1955.

Extension Work:

79. *Inland Swamp Development*.—Early rains again upset upland farming operations and more attention was paid to swamp rice farming, particularly in Bo and Moyamba districts. Bo District Council sponsored a swamp clearance scheme which was fairly successful, particularly in Baoma, Badja and Komboya chiefdoms.

80. The approximate acreages cultivated in recent years are as follows:—

<i>District</i>	<i>Year</i>	<i>Acreage</i>
PUJEHUN	1950	2,677
	1951	2,677
	1952	985
	1953	1,235
	1954	1,597
Bo	1950	1,455
	1951	1,514
	1952	2,624
	1953	2,836
	1954	4,912
MOYAMBA	1950	—
	1951	921
	1952	1,276
	1953	1,170
	1954	1,720

81. *Mangrove Clearance Scheme*.—The scheme was handed over to Moyamba District Council in 1953. Little progress was made in 1954; owing to lack of funds no loans were issued. Small areas, however, were cleared by farmers without financial assistance.

82. *Mechanical Cultivation*.—Mechanical cultivation was started at Gbundapi in 1951. Progress since then is shown in the following table:—

		<i>Acreage Ploughed</i>			
<i>Site</i>		1951	1952	1953	1954
PUJEHUN DISTRICT:					
Gbundapi ..	..	32	403	321	256
Saama ..	..	—	—	170	130
Njalunda ..	..	—	—	107	198
Panga Krim ..	..	—	—	—	25
Sulima ..	..	—	—	25	403
Total ..	..	32	403	623	1,012

83. The site at Marthyn, in Moyamba District, was closed down owing to difficulties of access and high transport costs. Pujehun District Council undertook the responsibility of paying for the cultivation done and collecting fees from farmers. Some difficulty was experienced in the collection of the fees. Yields from the cultivated areas were good, except at Sulima, where an unseasonable dry spell, soon after sowing, affected the rice adversely.

84. *Seed Rice Production*.—Bo District Council established seed production farms at Mandu, Bumpe, Niagorehun, Kakua and Badja, which produced a total of some 400 bushels of seed for distribution in 1955. In Moyamba District the Council purchased 150 bushels of swamp rice seed for future distribution.

85. *Cacao*.—There continued to be an improvement in the quality of cocoa produced. Production increased slightly. Owing to the high price of coffee interest in establishing new plantations was less than normal.

86. One fermentary was maintained at Futa, where in previous years a sound method of fermentation had been evolved. In 1954 the work was confined to confirming the results of previous experiments, and 12,121 lb. of wet beans were purchased from which 4,665 lb. of Grade I dry cocoa were produced.

87. *Cacao Varieties*.—The Amazon selections received from the Gold Coast and planted out in July, 1953, have made good progress. Out of 130 trees planted 117 have survived. Details are as follows:—

<i>Cross No.</i>			<i>Number Planted</i>	<i>Number Surviving</i>
T. 60/1775 x 1051	..	..	50	47
T. 85/779 x 876	..	..	48	41
T. 12/27 x 26	..	..	32	29
Total	..		130	117

88. *Coffee*.—Continued high prices brought about great activity and interest in the crop. New planting, and clearing of old plantations, was carried out on a considerable scale. The quality of coffee produced still requires improvement and efforts are being made to effect this by propaganda on proper harvesting methods and the introduction of small mechanical hullers.

89. *Piassava*.—Production increased and advisory work by Agricultural staff and District Council demonstrators continued. Some improvement in quality was noticed in Pujehun District. Co-operative societies in the Sulima-Potoru area set a fairly high standard in the production of good quality Sulima grade piassava.

90. *Oil Palms*.—Production and distribution of oil palm seedlings continued, but a falling off of interest was apparent, largely through difficulties over farming operations, due to adverse weather, and the migration of labour to more remunerative work in other areas.

				<i>Seedlings in Nurseries</i>	<i>Total Seedlings Distributed to all Destinations</i>
1950	..	..	..	21,000	8,600
1951	..	..	..	140,000	6,300
1952	..	..	..	123,000	66,400
1953	..	..	..	235,000	74,400
1954	..	..	..	209,000	93,800

Included in the 1954 distribution figures are 29,800 seedlings supplied to Masanki Plantation. Check surveys have indicated that survival rates are still disappointingly low, mainly due to lack of maintenance by farmers, destruction by rodents and delay in planting. Sites for two Pioneer Oil Mills were investigated, one at Momajo, in the Sumbuya-Medina area on the borders of the Bonthe District, and another between Rotifunk and Kasipoto. Replanting was started at Masanki Oil Palm Plantation, where 58,650 seedlings were transplanted.

91. *Cattle Fattening Scheme*.—Following the success of a small trial in 1953, the Pujehun District Council provided for the purchase and maintenance of 40 head of cattle in 1954. The beasts were purchased in Koinadugu District in January and sold off between June and September, after grazing on the riverain grassland areas near Gbundapi. Two animals died from snake bite and poisoning, but, despite this serious setback, a profit of £43 was made and further provision is being made for this very promising scheme.

92. *District Councils.*—The South-western Agricultural Circle covers three districts. The District Councils of Bo, Moyamba and Pujehun have now taken over the task of running nurseries for economic crops, seed rice farms, collection of ploughing fees, loans to farmers and the formation, through agricultural sub-committees, of their development plans, estimates, programmes of work and agricultural shows. A considerable amount of the Agricultural Officer's time has been devoted to assisting and advising them on their lately-assumed responsibilities.

SCARCIES CIRCLE

93. *The West African Rice Research Station.*—During 1954 the laboratories were completed and, with the facilities so made available, work proceeded more rapidly. Selection and breeding of improved rice varieties, investigation of tidal rice soils and control of crabs were the main activities. Details of the experimental work are given in the Annual Report of the Rice Research Station, published separately. The production of pure seed was 747 bushels (44,280 lb.). A small piggery was established during the year; it was stocked, in the first instance, with six hogs purchased from Port Loko District Council. An in-pig gilt was obtained from Newton to provide future breeding stock.

Extension Work:

94. *Swamp Clearance Scheme.*—The acreage of empoldered areas remains the same as last year:

Bakepet	..	..	..	..	..	205 acres
Bambaia	..	..	..	..	..	130 "
Mapotolon	..	..	..	..	..	498 "
						833 acres

The hand-constructed empolders at Bambaia and Bakepet have not come up to expectation. In these areas it is possible to grow rice without empolders and it has therefore been decided to leave the sluices open so that tidal washing can occur at all times. It may prove necessary to enlarge existing channels. At Mapotolon, on the other hand, rice cannot be grown without empoldering. Farmers in this area have shown increased confidence and have planted considerably more than they did last year. At Katema, in Mambolo Chiefdom, local farmers started on the reclamation of a saline area by improving the access for tidal water. They received no financial assistance and they nearly completed the first channel by the end of the year. Over two miles of natural drainage channel forming part of the Maseba Creek system were cleared for the improvement of water conditions on the surrounding swamps. Though considerable improvement has been effected excessive flooding from exceptional rainfall cannot be avoided. Good crops of rice were also obtained at Luti and Rosino where tidal conditions have prevailed since 1951.

95. *Mechanical Cultivation.*—Since farmers have been unwilling to contribute towards the cost of mechanical cultivation carried out in previous years, none was done this year. There are large areas of potential rice land suitable for mechanization, but, until the bulk of the rich tidal areas is occupied, it seems unlikely that much interest will be shown. It is possible however that, on the Little Scarcies, interest may be aroused by the results obtained, on the opposite bank of the river, in Port Loko District.

96. *Seed Rice Production.*—Production of seed rice on Native Administration farms amounted to 229 bushels (13,740 lb.). 480 bushels (26,400 lb.) of improved seed was purchased from farmers on behalf of other Agricultural Circles.

97. *Livestock.*—There are now four pig keepers in the Circle, but most of the pigs produced are disposed of in Freetown. There has been a noticeable increase in the number of sheep.

98. *Exports Crops*.—Oil palm seedling distribution has been taken over by the Kambia District Council, which has established its own nursery. The Council distributed 3,317 seedlings. A coffee nursery has also been established to meet the growing demand for seedlings and 2,000 seedlings were obtained for distribution from the South-western Circle. Owing to unfavourable weather conditions the groundnut crop was below average. Further plantations of bananas were made by local producers in anticipation of improved marketing facilities.

99. *Soil Conservation*.—The early burning of grasslands was carried out as in previous years by the Forestry Department, assisted by Native Administration and departmental staff. The flowering and fruiting of trees in the early burned areas is noticeably more prolific than in places where it has not been done.

PORT LOKO CIRCLE

100. *General*.—The Circle, which was established in 1952, is concerned mainly with the mechanical cultivation of rice in riverain areas, experimental work on the agricultural possibilities of *Lophira* bush, distribution of oil palms and development of pig keeping. Upland rice crops were poor this year and high floods caused some damage to swamp rice, but very good results were obtained in tidal areas. There was a noticeable migration of young men to the diamond areas and, in consequence, there was an increased interest shown by the farmers in mechanical cultivation.

Extension Work:

101. *Mechanical Cultivation—Swamp Rice*.—Mechanical cultivation has progressed as follows:—

				1952	1953	1954
Acres Ploughed	..	..	..	453	678	757

Yields were higher than in previous years and the overall average was estimated to be 1,020 lb. paddy per acre (17 bushels). Rotary cultivators were used extensively and proved very popular; although the rate of progress was slower than with a plough the ground did not need harrowing afterwards. The Kasanko-Mankara site was one of the first to be ploughed. It consists of two very different types of swamp, one flooding to 3 feet and the other to 8 feet during the height of the rains. In 1952 and 1953 results were very poor; this year however, following the results of past experience, early planting, plus the use of superphosphate, gave yields of 1,380 lb. per acre (23 bushels) on the deeply flooded land and 600–660 lb. per acre (10–11 bushels) on the shallower flooded parts.

102. *Agricultural Development of Lophira Bush Areas*.—In *Lophira* bush, the dominant tree is *Lophira alata*, in association with several species of tall grass. The latter is almost invariably burned in the dry season. A trial carried out at Malal in 1951 indicated that the growing of groundnuts might be profitable. Seven acres were cleared in 1952 and further clearing, by tractor and winch, was done in 1953, bringing the total area up to 53 acres, all of which was cultivated mechanically. The yield of groundnuts obtained by local farmers has been poor, mainly due to late planting and low soil fertility. In 1954 the area was ploughed and harrowed; most of the land was allocated for groundnuts but small plots of rice, fundi, benniseed and guinea corn were also planted. Fertilizer experiments on groundnuts were continued but yields were disappointingly low. Varying seed rates were used and, since in previous years responses to normal applications of fertilizer were poor, a massive application of superphosphate at 16 cwt. per acre was applied to half the plots. At each seed rate the seed was also (a) pre-soaked, and (b) untreated before planting. The mean effect of the fertilizer was to increase the yield from 488 lb. to 797 lb. but soaking the seed caused no change in the weight of nuts harvested. By far the best seed rate was three kernels per hole when fertilizer was applied, but without fertilizer the varying seed rates produced

little difference in yield. A small plot 22 yds. $\times$ 7 yds. of upland rice, broadcast with 4 cwt./acre superphosphate, yielded 713 lb./acre of dry paddy. Fundi, *Digitaria exilis*, dressed with 2 cwt./acre of superphosphate, yielded 400 lb./acre.

103. *Oil-Palms*.—Near Katonga, in Loko Masama Chieftdom, ten acres of *Lophira* bush were cleared with mechanical equipment and planted up with oil palms, at a cost of £5 16s. 0d. per acre excluding depreciation on equipment. Strips of ploughed land between the rows of palms provided an effective firebreak.

104. The distribution of oil-palms in recent years from District Council and Native Administration nurseries has been as follows:—

1952	..	..	..	..	..	5,772
1953	..	..	..	..	..	3,523
1954	..	..	..	..	..	12,124

The “ball of earth” planting technique was used in order to ensure better establishment than had been obtained in the past.

105. *Piggery*.—Thirty pigs were sold from the District Council piggery at Rosint, valued at £272 18s. 3d. Only two young pigs died during the year. Efforts to interest local farmers in pig keeping met with little success however, owing to the shortage of suitable feeding stuffs.

106. *Mangrove Clearance*.—At Yelibia, 89 acres of mangrove were felled during the year and clearing was started. Little interest was shown by farmers at Rowal, who have other sources of revenue apart from rice cultivation.

SOUTH-EASTERN CIRCLE

107. *Experimental Farm, Kenema*.—The farm was handed over to the District Council and activities were restricted to the production of seed rice and oil palm seedlings. Pig and poultry rearing ceased, with the exception of local Muscovy ducks. Approximately $2\frac{3}{4}$ acres of swamp were planted with four varieties of swamp rice. Superphosphate was applied at $1\frac{1}{2}$ –2 cwt. per acre. The average overall yield was 1,199 lb. paddy per acre, which is very satisfactory when it is remembered that this swamp has been under cultivation for the last thirteen years. The oil palm nursery is well stocked, and from it 8,330 seedlings were distributed during the year.

Extension Work:

108. *Swamp Rice*.—There was an increase in the cultivation of swamp rice, stimulated by the failure of burns on upland farms due to early rains. The planting of small patches of swamp continued well into September, which is later than normal for the district.

109. *Cocoa*.—Owing to the high price obtained for coffee last year there was less interest shown in planting cocoa. Farmers were instructed in the better preparation of cocoa and they paid more attention to the control of Black Pod disease. Quality was good, over 75 per cent of the crop being Grade I. No departmental fermentaries were operated and no monkey drive was held. Amazon cocoa planted in 1953 has made fair growth, though there have been several deaths. The number of trees are as follows:—

Cross No.	Kenema		Konia Island	
	Planted	Surviving	Planted	Surviving
T 85/799 $\times$ 876	4	3	44	34
T 60/1775 $\times$ 1051	5	4	54	35
T 12/27 $\times$ 26	5	4	30	25
T 65/203 $\times$ 202	3	—	6	—
	17	11	134	94
Total planted	..	151		
Total surviving	..	105		

110. *Coffee*.—Interest in planting was maintained, and it was found necessary to institute propaganda to counteract the harvesting of unripe cherries. Investigations into the possibilities of grading and different methods of preparation were started.

111. *Oil Palms*.—District Council nurseries were well stocked with young seedlings. Distribution was as follows:—

Kenema	8,330
Kailahun	2,113
Kono	9,118
	19,561 Seedlings

The establishment of District Council plantations at Senehun and Worodu continued. It was found that on land ploughed and harrowed by tractor the growth of young palms was better than on that which had not been cultivated. About 158 acres have now been planted at Senehun and 50 acres at Worodu. Farmers are encouraged to grow crops between the young palms since this is beneficial to the palms and reduces upkeep costs.

112. *Mechanical Cultivation*.—Ploughing and harrowing were carried out on the District Council oil palm plantation at Senehun. The objects were to assist in the establishment of the plantation by ploughing in the cane grass debris and to attempt to find a suitable rotation of crops for cultivating between young oil palms. 54½ acres were ploughed and 50½ acres harrowed, using a Fordson diesel wheeled tractor, Ransome disc plough and Countess disc harrow. Owing to mechanical faults a smaller acreage than was expected was cultivated. 38 acres were planted with upland rice by local farmers and 4 acres with a swamp variety. Yields, though poor compared with those in other districts, were apparently satisfactory to the farmers. Departmental test plots gave 240 lb. paddy per acre. Groundnuts yielded 300 lb./acre in the shell and 500 lb./acre when dressed with 2 cwt./acre superphosphate.

BONTHE CIRCLE

Extension Work:

113. *Mangrove Swamp Reclamation*.—Of loans outstanding under the old Mangrove Loan Scheme £198 14s. 1d. were collected, leaving £238 10s. 0d. outstanding out of £3,165 10s. 0d. issued between 1938 and 1952. Under the District Council Scheme 400 acres of mangrove have been felled and 141 acres cleared. No new felling was done by the District Council this year and little by farmers themselves. Progress was slow owing to the migration of young farmers and to the abandonment of some farms due to “kiri kiri” grass, *Paspalum vaginatum*, which continues to be very troublesome on tidal land. Trials with hormone weedkillers to control this grass were unsuccessful and at present the only practicable method is the use of a broad-bladed hoe. Further trials with arboricides on *Rhizophora* mangrove were made, using stronger solutions and methods of application different from those used in 1953. The following results were obtained:—

Control—Ring barking and vertical cuts, no arboricides—no effect.

2,4-D—painted on bark and through cuts at 6 and 10 lb. acid equivalent per acre—resulted in defoliation and eventual death.

2,4,5-T—At 10 lb. acid equivalent per acre—similar results but slightly less effective than 2,4-D.

MCPA—As for 2,4,5-T.

Ammonium sulphamate—No effect.

114. *Trials of Imported Rices.*—Nine varieties of new introductions received from Rokupr Rice Research Station were grown on a tidal mangrove swamp at Yagoi. Two pounds of seed of each variety were sown. Results were as follows:—

<i>Variety</i>							<i>Yield lb./Acre</i>
C 24/102	..	..	..	..	..	..	3,067
H.M.C. 19	..	..	..	..	..	..	2,960
Ebandioul	..	..	..	..	..	..	2,890
Siam	..	..	..	..	..	..	3,468
HR 1..	..	..	..	..	..	..	1,183
Radin China	..	..	..	..	..	..	3,125
Reyon 6	..	..	..	..	..	..	1,930
Raminad	..	..	..	..	..	..	1,411
Elon Elon	..	..	..	..	..	..	1,874

115. *Mechanical Cultivation.*—Progress since the beginning of the scheme has been as follows:—

<i>Year</i>							<i>Acres Ploughed</i>
1949	..	..	..	..	..	..	4
1950	..	..	..	..	..	..	69
1951	..	..	..	..	..	..	282
1952	..	..	..	..	..	..	465
1953	..	..	..	..	..	..	1,178
1954	..	..	..	..	..	..	2,278

Early rains in April resulted in 132 acres being flooded before planting could be done, and 86 acres were not planted due to a shortage of seed. The tractors used were one Fowler V.F.A., eleven Fordson Majors on County full-tracks and one on Cuthbertson half-tracks. Owing to the late arrival of spare parts only eight of these tractors worked the full season. The principal implements used were Ransomes and Massey-Harris disc ploughs with Massey-Harris "Goble" and Ransomes "Countess" disc harrows. The initial clearing of the tall and heavy growth of grass (up to 10 feet high) is now being done entirely with "Goble" off-set disc harrows. The grass is cut and bruised sufficiently for it to dry out and it is then burned off.

116. Rice yields have continued to be good, ranging from 1,500–1,800 lb. paddy (25–30 bushels) per acre. Experiments on time of planting, application of superphosphate and variety trials were carried out on various plough sites. The results confirmed previous conclusions.

117. *Time of Planting Trial.*—Results were as follows:—

<i>Date of Planting</i>					<i>Yield lb. Paddy per Acre</i>		
					<i>Subu</i>	<i>Massa</i>	<i>Gandema</i>
7/3/54	..	..	..	..	1,128	1,416	648
27/3/54	..	..	..	..	1,152	1,200	1,056
7/4/54	..	Average of Controls			1,236	984	866
7/4/54	..	..	..	..	1,452	1,056	336
17/4/54	..	..	..	..	1,464	1,026	1,440
27/4/54	..	..	..	..	1,680	984	2,208
7/5/54	..	..	..	..	792	1,078	1,704
17/5/54	..	..	..	..	1,524	816	168

At each site seven plots each 1/12th acre were planted at different dates, with control plots planted on 7th April between them and at each end. The indications are that to get optimum yields at Subu planting should be between 27th March and end of April, at Massa before 17th April and at Gandema between 17th April and 7th May.

118. *Fertilizer Trials*.—Superphosphate was applied to $\frac{1}{4}$ acre plots at the rate of 2 cwt. per acre. Results were as follows:—

Site	Variety	Yield lb. Paddy per Acre		
		Fertilized	Control	Difference
Subu	Indo China 53	2,000	1,800	+ 200
	Indo China 53	920	1,600	— 680
	Indo China 53	1,840	800	+ 1,040
Kpatobu	Indo China 53	2,080	1,800	+ 280
Mayike	Meike	1,800	1,656	+ 144
Makita	Meike	880	1,780	— 900
	Meike	1,200	1,840	— 640
	Meike	1,920	1,280	+ 640
Bullom	Indo China 53	1,432	1,052	+ 380
	Indo China 53	1,888	1,868	+ 20
Kiban	Indo China 53	1,296	1,264	+ 32
	Indo China 53	2,520	2,296	+ 236
Average		1,648	1,620	+ 28

On the whole there is no indication that the use of superphosphate is worthwhile on these naturally fertile grasslands.

119. *Variety Trials*.—Results of Variety Trials on these deep flooding grasslands over the last five years are as follows:—

Selection	Yield in lb. Paddy per Acre					
	1950	1951	1952	1953	1954	Average
Indo China 22	2,080	1,786	340	1,656	1,092	1,391
Indo China 24	2,125	2,193	114	1,440	1,090	1,392
Indo China 53	2,458	1,830	1,856	1,105	1,050	1,660
Indo China 62	1,770	1,267	750	1,368	992	1,230
Indo China 70	832	1,608	143	1,260	992	967
Indo China 81	1,217	1,167	443	660	933	884
Mbagboli (Control) ..	1,059	1,629	328	888	840	949

Indo China 53 continued to give the highest average yield and is being grown on an increasing scale by local farmers.

120. *Piassava*.—Production was increased, partly due to the increase in price in 1953 which led to an increase in the quantity of raw material put into ret late in 1953 and early in 1954. Fluctuations in price of this crop, which are frequent due to a rather inelastic demand, have a marked effect on production. The co-operative societies continued to be popular and are an excellent medium through which to get correct methods of preparation established.

121. At the Piassava Experimental Station the long-term rotational cutting experiment was continued. A further experiment on time of retting confirmed that 18 weeks is the minimum period required to produce clean fibre free from pith. Owing to lack of staff the number of experiments carried out so far has been limited.

122. *Oil Palms*.—Improved oil palm seedlings numbering 1,898 were distributed this year, bringing the total distributed in Bonthe District since 1949 to 7,937. A District Council Oil Palm Plantation was established at Gambia in Jong Chiefdom adjacent to the Pioneer Oil Mill, and a District Council nursery has been established in the same place. Interest in oil palms generally has declined and the production of oil and kernels was less than usual.

123. *Coffee*.—Interest in coffee occasioned by high prices was maintained and the establishment of new plantations continued actively.

124. *District Council*.—An Agricultural Superintendent and two Agricultural Instructors were assigned to the District Council. The work undertaken by the District Council includes allocation of plots and collection of ploughing fees on mechanical cultivation sites, supervision of oil palm distribution, the mangrove felling team, piassava advisory work and inland swamp clearance schemes. Agricultural work is dealt with by a special sub-committee.

MAKENI CIRCLE

125. *General*.—The work of Makeni Circle aims at the extension of new farming systems and techniques which have been developed from the results of previous trials and experiments. Following the transfer to District Councils of several well-established projects, together with the assignment of junior technical staff, it has been possible to devote more attention to the development of mechanised rice production in the boli-lands which cover a large part of this Circle. A number of buildings were erected at Batkanu in connection with the mechanical centre which is being established there.

126. *Inland Swamp Cultivation*.—The demonstration farms at Makeni and Makali, originally established by the Department, have been handed over to the Bombali and Tonkolili District Councils respectively. It was on these farms that the possibilities of further development were worked out. In 1946 a series of swamp development schemes was initiated, and from them was developed the present system whereby farmers are given a bonus by the District Council for swamp development carried out by themselves. This work has continued to expand rapidly wherever suitable swamps exist. From 1946 to 1953, 307 acres were cleared under departmental and Native Administration schemes. In 1954 a further 236 acres were cleared under the District Council Bonus Scheme, at a cost of approximately £2 5s. 0d. per acre.

127. *Ox Ploughing*.—The number of farmers in the Mabole Valley area remained at 74. Trials with superphosphate on their rice crops gave good responses, and it seems likely that it will be widely used.

128. *Mechanised Cultivation of Swamps*.—The following table shows how the scheme has been developed in this Circle since its inception:—

Site	Acres Ploughed		
	1952	1953	1954
BOMBALI DISTRICT:			
Bantoro (Sanda Chenraron)	238	417	435
Rochen " "	—	190	301
Malama " "	—	—	101
Mangara " "	—	—	167
Rogaret " "	—	—	209
Mabenji (Pendemba/Gowahun)	—	—	378
Private Farmer ..	—	—	9
Total ..	238	607	1,600
TONKOLILI DISTRICT:			
Masimo (Kholifa Mabang)	—	308	294
Rochendokom (Malal-Mara)	—	—	310
Masugbe ..	—	—	245
Total ..	—	308	849
Grand Total	238	915	2,449

Previous experience was confirmed in 1954 that successful rice farming in the boli-lands depends upon the use of superphosphate, early planting and control of weeds in the young crop.

129. The average results from Fertilizer Trials on five different boli-land sites were as follows:—

Control. No Fertilizer	..	..	..	..	571	lb./acre
2 cwt./acre superphosphate	..	..	..	..	856.7	lb./acre
				<i>Increase</i>	285.6	lb./acre

The yields were low owing to a number of experimental plots being damaged by excessive flooding. In previous years, at Bantoro, yields in lb./acre were:—

<i>Treatment</i>				1952	1953
No Fertilizer	..	..	..	675	1,200
1 cwt./acre superphosphate	..	..	..	1,500	1,800
2 cwt./acre superphosphate	..	..	..	1,950	1,950
3 cwt./acre superphosphate	..	..	..	2,100	2,250

130. Though 600 acres were not taken up by farmers, due to the attraction of young farmers to illicit diamond mining, there was considerable interest shown, crops were very fair and outstanding ploughing fees were collected with little difficulty. The possible use of wheeled tractors is under investigation, likewise the wider use of combine drills. Two Massey-Harris Rice 80 Special Combine Harvesters were tried. They proved efficient and worked well under very diverse conditions, though it seems that they may be uneconomic to operate at present.

131. *Swamp Seed Rice Distribution.*—Assistance and advice were given to local farmers in maintaining the purity of rice intended for seed. District Councils maintained seed producing farms and production from these was supplemented by stocks from the West African Rice Research Station at Rokupr. In all some 30,000 lb. (500 bushels) of improved seed rice were distributed.

132. *Livestock and Poultry.*—When available Rhode Island Red poultry has been distributed to local farmers, but the demand far exceeds supplies. Encouragement has been given to the keeping of local ducks, which do well, and for which there is considerable scope for development.

133. *Oil Palm Planting Programme.*—There was a decline in the demand for oil palm seedlings this year. Comparative figures are given below:—

1948	1949	1950	1951	1952	1953	1954
3,630	4,455	12,053	25,675	43,396	48,744	30,583

The raising and distribution of oil palms has now been handed over entirely to District Councils. Nurseries have been centralised for sowing and ease of supervision.

134. *Coffee.*—Considerable interest has been shown and there was a large demand for seedlings. District Council nurseries were established and seedlings from old and neglected plantations were collected for distribution. Some 200,000 seedlings of *Robusta* coffee were made available in this way. Not only has the high world price of coffee stimulated interest but local market prices were high as a result of the increased local consumption.

135. *Miscellaneous Crops.*—The cultivation of market garden crops continued to expand, both in swamps in the dry season and on the uplands during the rains. Peppers and minor field crops such as guinea corn, pigeon peas, maize, *et cetera* gave satisfactory yields. Fruit was plentiful and, after many years of distributing fruit trees, there is now an adequate local supply of grapefruit and oranges.

136. *Soil Conservation.*—In conjunction with the Forestry Department and the Provincial Administration the routine early-burning of grasslands was carried out. The effects of this practice are beginning to be noticeable. In certain areas there are indications that the "bush" is regenerating. Farmers are being encouraged to move into the mechanically cultivated areas for rice production and to use their upland areas for the production of oil palms, coffee, fruit trees and other permanent crops.

MUSAIA CIRCLE

Musaia Stock Farm:

137. *Animal Husbandry*.—The new general policy was indicated in the Annual Report for 1953. During 1954 work was concentrated on re-organising and building up the foundation herd and improving it for beef production. This entails, in particular, selection for early maturity with regular breeding. With this is coupled investigations into suitable fodder plants which can be used widely for improving grazing under ranch conditions.

138. *Maintenance*.—Repair of the perimeter and internal fences was undertaken and completed during the year. Concrete posts were erected at 40-foot intervals with four strands of barbed wire. The perimeter fence is a double one. The road in the new lease was extended and its level raised in places liable to flooding. Improvements to roads, buildings and dams were carried out.

139. *Rice*.—Forty-eight acres of rice were grown, mainly in swamps where water is conserved by simple earth dams for watering cattle and maintaining good grazing in the dry season. Ploughing was done either by tractor or ox-ploughs. Yields were generally above average but 14 acres sown on riverain grassland failed because the Mongo River did not flood this year. The swamps in which rice is grown form a part of each grazing area on the station and serve as demonstrations of improved agricultural production under settled conditions of herd management, apart from supplying pure rice seed for distribution.

140. *Forage Crops*.—The grass *Axonopus africanus* has shown promise for providing dry season grazing on low-lying ground. It has proved difficult to find an economical method of establishing it since it does not grow well from seed. *Pueraria* is a promising leguminous crop which can be established from seed but obtaining large quantities of seed is difficult. *Stylosanthes gracilis*, recently introduced, is also being tested. The main object is to find fodder crops which will provide grazing in the dry season under natural conditions. So far it has been found that a zone of *Axonopus* round the edge of the swamps with a zone of *Pueraria* at a higher level effect a marked improvement in grazing in the savannah area.

141. *Pigs and Poultry*.—Pigs suffered from an outbreak of trypanosomiasis during the wet season, which was controlled by a double dose of antrycide metasulphate, followed by prophylactic treatment with antrycide prosalt at ten weekly intervals. Shortage of feeding stuffs was experienced and in consequence of this, together with the limited local demand, a reduction in the number of breeding stock is contemplated. The numbers of poultry increased rapidly towards the end of the year and there was a very considerable local demand.

142. *Cattle*.—The breeding policy has remained unchanged, the object being to breed for early maturity. The number of breeding females was allowed to increase to 130, so that closer culling or a revision of the selection standards is now possible. Bulls were run with Herds 1 and 2 from July to the end of September and with Herds 3, 4 and 5 from August to the end of October. This was a deviation from normal practice, necessary because not all the females had been inoculated with S. 19 vaccine against Brucellosis. The restricted breeding period appears to have resulted in heavier calves and reduced mortality. A preliminary selection of young bulls was made in October which resulted in twenty-four being discarded. These were castrated and are being trained for use as working animals and for fattening.

Extension Work:

143. *Cattle Owner Settlement Scheme*.—This scheme started in 1953 in co-operation with the Koinadugu District Council, its aim being to encourage the settlement of nomadic Fula cattle owners. In 1953 seventeen settlement areas,

each of one square mile, were surveyed, and fourteen occupied. This year a further nineteen were surveyed for settlement in 1955. In each area an earth dam with a sluice and spillway were constructed to conserve water for cattle in the dry season and provide extra grazing. In consequence conditions during the wet season are also improved for swamp rice cultivation and high-yielding forage crops can be established round the margins of the swamps. Some of the dams did not prove sufficiently robust and had to be rebuilt, and modifications to some of the sluices were necessary. *Axonopus africanus* and *Cynodon dactylon* were planted on the dams to strengthen them. Areas on settlements sown with *Axonopus* seed were only moderately successful but the *Pueraria* strips were generally good. Newly-settled cattle owners have not all started rice cultivation, but those who have obtained very satisfactory yields. This scheme has made a good start and there were a large number of applications from cattle owners for settlement areas.

144. *Mechanical and Ox-Ploughing*.—During 1954 the training of oxen for sale to local farmers for ploughing continued on the District Council farm. Oxen are more suitable than tractors on the long narrow swamps which are characteristic of the Koinadugu District. Since the beginning of this scheme in 1953 44 oxen and 21 ploughs have been distributed. There are, however, certain areas which are large enough for the use of tractors, and 127 acres were ploughed by the Musaia tractor.

145. *Distribution of Planting Material*.—The distribution of oil palm and fruit tree seedlings from the District Council farm at Kabala and the Native Administration nursery at Fadugu continued. Another nursery was established at Bafodea during this year. The demand for seedlings of oil palms, coconuts, citrus, coffee and other fruit trees is very large since there is a shortage of economic trees generally in the District.

COLONY CIRCLE

146. *General*.—During the year the Circle was reduced in area by the transfer of Koya Chiefdom to the Port Loko Circle. This was desirable for administrative reasons, as Port Loko Circle did not previously cover Port Loko District. The headquarters of the Circle is at Newton, where there is an experimental and livestock breeding station situated on a site typical of the Eastern Colony. The soil is sandy and of low natural fertility. In this Circle maintenance of fertility is a major problem, except in the tidal and inland swamps, as the rainfall is high and the land overfarmed.

Newton Experimental Station:

147. *Pigs*.—During 1954 19 litters were farrowed by Large White and 9 by Wessex Saddleback pigs; from these a total of 168 piglets were reared. Litter averages were as follows:—

	Large White			Wessex Saddleback		
	1952	1953	1954	1952	1953	1954
Number Born ..	9.3	8.4	8.5	6.3	7.0	7.8
Number Reared ..	6.6	7.0	6.0	4.5	4.5	6.5

The number of breeding stock was increased at the end of 1953, which resulted in an increase in the numbers distributed; 92 were sold for breeding and 70 for slaughter to the value of £1,650. The stock at the end of 1954 totalled 128. There was difficulty over the supply of feeding stuffs owing to periodical shortages of rice bran and broken rice, but this was overcome by feeding palm kernels unfit for export and cassava meal. The building of a new piggery, which it is intended to run as a commercial unit, was completed towards the end of the year.

148. *Poultry*.—Expansion of the stock of Rhode Island Red fowls by the importation by air of day-old chicks was continued. Extra incubators and improved brooders have made possible a rapid increase in numbers so that it has been possible to test intensive methods of poultry keeping. In 1953 small experiments with battery cages and a deep litter house gave encouraging results. This year a deep litter house for 500 fowls was constructed and put into use. Pullets introduced between August and November came in to lay by December and production averaged 170 eggs per day from 450 birds. There was a marked increase in egg production, mainly due to this deep litter house. 4,900 eggs were sold for hatching and surplus eggs were disposed of through commercial channels and, in addition, 549 six week-old chicks and adult birds were sold for breeding. Muscovy ducks continued to thrive and the total stock was increased. Chinese Geese remained healthy but their numbers have not increased as rapidly as it was hoped, due to complications over egg fertility which are being investigated.

149. *Tree Crops*.—Oil palms made excellent growth. Angola palms planted in 1947 gave approximately 1,000 lb. of fruit per acre while Nigerian and Deli palms planted since 1950 are coming into bearing. There was a poor crop of avocado pears this year and old trees were replaced. Citrus yielded heavily but the cashew crop was poor and yields were less than 100 lb. of nuts per acre.

150. *Model Holding*.—This has been worked by a farmer since May 1951 to demonstrate the efficient use of inland valleys. The main sources of income were from the sale of livestock, vegetables and seedlings. Rice was retained for household use and cassava and pawpaws used to supplement purchased pig food. The model holder has had considerable success with pigs, fowls and ducks, which have increased his revenue and provided much-needed organic manure.

151. *Annual Crops*.—Investigations into the problem of cultivating degraded upland soil continued. Promising results have been obtained by contour bunding and the use of grass strips to check erosion, coupled with the use of farmyard manure and fertilizers. The fertility of one block on the farm so treated is markedly improving. Crops grown included cassava intercropped with Waterloo beans and Musaia cowpeas, Chinese yams intercropped with maize, and *Stylosanthes gracilis* and *Pennisetum setosum* as fodder crops.

152. *Chinese Yams*.—As there is a good demand for planting material Chinese yams are grown each year to multiply stocks. Yields of the crop in recent years have been as follows:—

Yields of Chinese Yams in lb./Acre			
1951	1952	1953	1954
1,470	3,450	12,370	4,570

From observations it appeared that the variability in yields has been due largely to the quantity of manure applied and the earliness of the date of planting.

153. In view of this variability a simple experiment was laid down in 1954 to check the observations. Farmyard manure was applied at 20 tons per acre and capping was included in the experiment to see if it had any effect. Results were as follows:—

Chinese Yams Treatment				April Planted Yield lb./acre	May Planted Yield lb./acre
Manured, capped	..	..	..	19,500	11,250
Manured, uncapped	..	..	..	17,000	8,250
Control, capped	..	..	..	2,506	1,600
Control, uncapped	..	..	..	1,050	1,250

From these results it is clear that high yields are, as was expected, dependent on heavy organic manuring combined with early planting. Capping also gives higher yields.

154.—*Fertilizer Experiments.*—Various experiments indicated that Chinese yams give little response to artificial fertilizers but that sweet potatoes and cassava respond to phosphate and potash. Groundnuts respond well to nitrogen, phosphate and potash but phosphate is a limiting factor and no increase in yield is obtained from any fertilizer treatment if this is omitted.

Extension Work:

155. *Rice Swamp Development.*—Empoldered saline mangrove land at Maswari gave better yields than in 1953 and farmers obtained about 1,200 lb./acre of paddy. The following table shows the yields in recent years on the departmental four-acre polder:—

Year	Average Yield lb./Acre Paddy			
1950	..	..	..	1,211
1951	..	..	..	1,502
1952	..	..	..	728
1953	..	..	..	1,158
1954	..	..	..	1,504

Inland swamp clearance schemes at Kotopema and Campbell Town, which totalled 100 acres in 1953, were not expanded. The response by local farmers has been disappointing and many farmers prefer to hire labour rather than do the work themselves. On the other hand farmers in the mangrove areas on Songo creek made good progress and continued mangrove clearing.

156. *Waterloo Oil Palm Plantation.*—Efforts were particularly directed towards measures to prevent damage to young palms by rodents. These comprised frequent brushing, organised hunting and the provision of wire netting collars. The last were most effective, and in all 45 acres of young palms were protected in this way. Intercropping by local farmers was encouraged. Seedlings in the new nursery grew well; 14,680 were used as replacements on the plantation and 12,935 were distributed to local farmers. The survival rate at the end of the year was high due to adoption of the “ball of earth” technique of planting recommended by the West African Institute for Oil Palm Research.

157. *Coffee.*—Distribution of *Robusta* coffee seedlings from the Rural Areas Council nursery totalled 18,400 and *Stenophylla* 485. Considerable interest has been aroused in coffee by the recent high prices.

158. *Fertilizers.*—Fertilizer demonstrations on local farmers' crops of rice and cassava have resulted in a developing interest in this means of increasing yields.

C—HORTICULTURAL SECTION

159. The work of this section has been directed towards increasing the quality and quantity of vegetable and fruit produced both in Freetown and the Provinces. Soil conservation by terracing, the provision of seeds, fertilizers and planting material and advice as to their use have formed the basis of extension work.

160. *New England.*—This station, close to Freetown, is the headquarters of the section, and here trials of new introductions, fertilizers and pest control methods continued. There were many visitors to the station, where demonstrations were arranged and in many cases followed up on the visitors' own holdings. A plant house was completed and wired for electricity so that a soil sterilizer could be used. Further terracing has been carried out to provide extra room for propagation.

161. *Lumley Sub-Station.*—This continued mainly as a propagation centre. Experimental work was done on tomatoes and trials of vegetable varieties continued. During the wet season rice was grown instead of vegetables and gave an average yield of 840 lb./acre. Mechanisation was introduced wherever possible.

162. The propagation of fruit trees, particularly citrus, was continued. Stock plants were increased both in number and variety, with particular attention to pineapples. A concrete water tank of 1,500 gallons capacity was constructed in order to provide a reserve of water for emergency use in the dry season.

163. *Pigs and Poultry*.—Buildings were extended by the addition of a new block, consisting of an incubator room, store, deep litter house and food preparation room. Rhode Island Red fowls supplied hatching eggs for sale to local poultry keepers. Muscovy ducks and four Chinese Geese were obtained from Newton.

164. Visitors took a keen interest in the livestock section which not only provides a useful demonstration for local stock keepers but also much-needed manure for the vegetable gardens.

165. *Gloucester Demonstration Garden*.—This was started in 1952 as an advisory and demonstration centre for vegetable growing. During the wet season a crop of rice was grown which yielded 800 lb./acre of paddy, a satisfactory yield in this area.

166. *Regent Rural Area Nursery*.—The nursery was started in 1952 to demonstrate improved methods of vegetable growing in the mountain area and to provide planting material of economic tree crops. A striking feature of this holding is a demonstration of simple progressive terracing which can be carried out while a crop is growing. In this instance pineapples were planted approximately on the contour, with two stands of lemon grass between plants. This served to check erosion from the start. Later, stones exposed by subsequent cultural operations were packed between the pineapples and the lemon grass, which completed the anti-erosion barrier without disturbing the pineapples. The result is that small step terraces are being formed while the crop is growing. In course of time they will develop into stone-faced bench terraces.

167. *Kabala Sub-Station*.—A suitable site near Kabala in Koinadugu District was selected in 1953. During 1954 demonstration beds were laid out, an irrigation system installed and some of the necessary buildings erected. The use of sunken beds in the dry season was a new innovation in this area which is suitable for producing excellent vegetables. Selected varieties of cabbage, tomatoes, onions, beans and maize were grown. Advice, seeds, fertilizers and fruit tree seedlings were made available to trial growers.

168. *Experimental Work*.—Most of the experimental work was devoted to attempts to discover how to control Bacterial Wilt of tomatoes, a very widespread disease which causes a considerable loss of crop. Chemical soil sterilizers tried previously were too expensive but promising results have been obtained from applying powdered ginger peelings to the soil. At Lumley the survival rate was raised from 72 per cent to 94 per cent, and a similar increase occurred in further trials at New England. A local grower who had seen these trials reported that he had obtained good results from applying a preparation made by boiling ginger roots in water. A preliminary trial on heat sterilization was carried out. Soil known to be infected was treated in an electric sterilizer at 180° F. for 90 minutes. Tomato plants grown in this soil remained uninfected whereas those in the untreated soil all wilted. However the cost of this treatment may make it uneconomic for small-scale local growers.

169. *Extension Work*.—Growers in both the Colony and Protectorate continued to receive technical advice and assistance with their problems from the staff. The use of fertilizers, improved varieties of seeds, insecticides and modern methods of cultivation have all been advocated and demonstrated. In addition sales of fertilizers and seeds have continued. School gardening has been encouraged at schools where suitable land is available as it is considered essential that young people should be encouraged to adopt a deeper interest in agricultural and horticultural work. Over 1,000 visits of an advisory nature were made by staff of this section during the year.

170. *Horticultural Show*.—The third annual Horticultural Show was held in Freetown on 1st April and was very successful. The show was sponsored by the Agricultural Department and the Rural Area Council.

171. The Horticulturist continued to give lectures and show films. The series of pamphlets "Horticultural Notes" was extended, and large numbers distributed. These notes are of a technical nature and are designed to acquaint growers with improved methods of cultivation, methods of insect control and other details concerning the growing of fruit and vegetable crops.

D—NJALA TRAINING COLLEGE

172. *Agricultural Course*.—This year saw the introduction of the scheme whereby students undergo their field work before entering the College instead of on the completion of their academic course. Entry into the College is now regulated by a qualifying test and in the light of reports from Agricultural Officers to whom students have been attached. By this method it is hoped to reduce wastage at the College and maintain a high standard. Under the scheme, which is similar to practice in the United Kingdom, 21 students were recruited, of whom 18 will enter the College in 1955.

173. During the year ten senior students, including one from the Gambia, successfully completed the course and were posted to various Agricultural Officers for six months practical work. Reports have indicated that the ability and standard of these students is well up to average.

174. There were fourteen junior students in residence at the beginning of the year. This group was, on the whole, below standard, and it was found necessary to withdraw the scholarships of four students owing to lack of progress and of one other for disciplinary reasons. The remaining nine students should eventually become Agricultural Instructors of satisfactory ability.

175. Lectures and practical work continued according to the revised syllabus, with the usual interchange of agricultural and education staff. Practical work during the year included the maintenance of the permanent plots and the cultivation of the annual plots with rice, maize, cassava, guinea corn and other minor crops. The students also rebuilt the nursery shed and rabbitry and were responsible to a large extent for the maintenance and upkeep of the College grounds.

176. The piggery and cattle byre were completed by the Public Works Department and a considerable expansion in livestock activities has been accomplished. The College now has three breeding sows and good facilities for rearing and fattening pigs. Towards the end of the year three cattle were obtained from the Agricultural Officer, Njala. The number of animals which can be kept is limited by the grazing available, but they are invaluable in familiarising students with the handling and rearing of cattle. Rabbits and poultry continued to do well. The rabbitry was rebuilt and all hutches were reconditioned or replaced, permitting a further expansion in this section. Development of poultry keeping is envisaged in 1955.

177. The teaching of the use and principles of farm machinery was greatly facilitated by the acquisition of a second Allen Scythe and a Ransomes motor mowing machine from Bo School, also by the loan of an M.G. 5 tractor and implements by the Agricultural Officer, Njala.

178. Considerable progress was made during the year, especially in the fields of animal husbandry and farm mechanisation. With more funds being made available these subjects, which have not previously received the attention they deserve, will take a more prominent place in the curriculum.

E—RESEARCH

PLANT PATHOLOGY SECTION

179. The Plant Pathologist was in Sierra Leone the whole year and reports as follows:—

(1) Over 500 collections of fungi and nearly 100 lichens were made during the year and sent to the Commonwealth Mycological Institute and Kew Herbarium, duplicates being kept at Njala. Thanks are due to the staff of both these institutions for assistance with identification.

(2) The phanerogamic herbarium remained under the Plant Pathologist's supervision during the year. About 160 new collections were added, mostly by the Plant Pathologist's section, duplicates being sent to Kew Herbarium. Owing to the leak in the roof over the main herbarium new cupboards had to be made hurriedly late in the year, and the redistribution of the herbarium was only just completed by Christmas. A heater and fan was installed in the phanerogamic and mycological herbarium rooms this year and has proved very valuable in keeping collections dry during the wet season and in effecting rapid drying of fresh specimens at that time.

(3) A revised bulletin of "Diseases of Cultivated Plants in Sierra Leone" was prepared for publication to replace and bring up to date the similar bulletin written in 1943, which has long been out of print.

(4) A vernacular botanical vocabulary for Sierra Leone was prepared for publication.

(5) *Cephalosporium eichorniae* Padw. was recorded causing the characteristic zonate leaf spot on two new host plants at Njala: Ramie fibre (*Boehmeria nivea*) and the wild *Croton dispar*.

(6) Angular brown leaf spot of *Zinnia*, probably due to *Xanthomonas nigromaculans* f. *zinniae*, was recorded for the first time at Njala, where it was common especially on the older leaves during the wet months of July and August.

(7) A brown angular leaf spot of groundnut (*Arachis*), associated with bacteria, appeared commonly at Njala in August a few weeks before the groundnuts were due to be harvested. Its importance is unknown.

(8) *Oil Palm*.—*Cercospora elaeidis* Steyaert was a common cause of leaf spotting of seedling oil palms at Njala in June on the earlier formed leaves after pricking out into nursery beds. Later formed leaves were free from attack and the disease was not serious. The disease was also seen in the nurseries at Newton, but was again of minor importance.

(9) *Rice*.—Leaf-break, associated with a species of *Neottiospora*, was fairly common at Masimo (Kholifa Mabang) in October, on India pa lil 46 especially, and on Ngasein. The early varieties D. 114, B.G. 79 and D. 99 were practically free from attack. Mr. E. H. Nichols, Senior Agricultural Officer, reported that the attack was most severe on drier areas and less on the areas with standing water. This fungus, which attacks the leaf at the junction between the blade and the sheath, was first recorded at Maswari in 1952 (see Annual Report for 1952): the leaf blade eventually breaks away from the sheath and the surface of the water between the rice plants, in severe attacks, looks as if it had been strewn with grass.

(10) *Rice*.—False Smut [*Ustilaginoidea virens* (Cke.) Tak.]—Mr. W. MacNab reports that this year at Masimo and Roehen *Ustilaginoidea* attacked Ngasein 57 only. Other rice varieties growing there and not affected were Sughandi, Panianala, India pa lil (at both places), Toma 112, D. 114, D. 99, DC. 39 and the local strains Pa-Kema and Pa-Lal (at Masimo), and Lead and the local strains Pa-Lath and Pa-Kanlu (at Roehen). All except the local strains were supplied from the Rice Research Station at Rokupr.

(11) *Pawpaw*.—Mildew (*Ovulariopsis papayae*, Van der Byl) was recorded for the first time in Sierra Leone on leaves of seedling pawpaw plants at Murray Town (near Freetown) in early January, 1955.

AGRICULTURAL CHEMISTRY SECTION

180. The Chemist was in charge of the Section until the end of November when he proceeded on vacation leave. Recruitment of laboratory assistants remained a problem. There has been one vacancy now for nearly three years and there seems little hope of filling it at present with a suitably qualified person.

181. *Laboratory Investigations*.—With the installation of a reliable electricity supply the opportunity has been taken to equip the laboratory with electrical apparatus and this has been nearly completed. All mechanical analyses are now done by hydrometer after dispersion with a high-speed electric stirrer, whilst a high output electrically heated glass still has greatly simplified work on trace elements.

182. The routine analysis of soils continued but on a smaller scale than in previous years. Among several special soil investigations carried out during the year was one on the corrosion of iron pipes in acid ferruginous soil in connection with the proposed Bo water supply.

183. Studies on methods of plant analysis also continued. For rapid routine analysis a slight loss of sensitivity is less important than speed and reliability. Successful methods were devised for several nutrient elements and a large number of analyses were performed in connection with fertilizer experiments but certain elements, including potassium, still raise difficulties.

184. *Soil Fertility and Fertilizers*.—The resources of the section for the past few years have been concentrated on the study of problems of soil fertility. The value of superphosphate as a fertilizer has been firmly established for almost all crops and soils in the country and considerable increases in yield can be expected from dressings as low as 1 cwt. per acre. The optimum dressings and the best time of application to swamp rice are reported in the 1953 Annual Report and experiments on upland crops confirming the value of superphosphate are given in the Annual Reports for the last three years. Unfortunately soil and plant analyses are of little value for predicting the optimum quantity of superphosphate to apply, but experience has shown that up to 2 cwt. per acre is generally profitable. At many places simple trials have been carried out to determine the optimum dressing, and at least one has been done on each mechanical cultivation site.

185. Although all soils which have been examined are low in nitrogen the application of nitrogenous fertilizers has shown little effect on crops. Exceptions to this have been recorded. For example, on the sandy soils of the Newton area, both upland and swamp, sulphate of ammonia improves yields when applied with superphosphate, but not alone. Fertilizer demonstration plots on Newton Experimental Station have confirmed this for almost all local crops. Another area where nitrogenous fertilizers are of value is in the fertile valley swamps around Kabala, where they have been used on swamp rice in conjunction with superphosphate. In other areas sulphate of ammonia often reduces growth, especially of cassava and citrus.

186. Many soils appear to have an adequate level of potash, but it is possible that tree crops such as cocoa, coffee and oil palms benefit from applications of sulphate of potash.

187. Liming has been found to have little effect.

188. *Maintenance of Fertility of Upland Soils*.—This is a perpetual problem in all tropical countries where rainfall is high. So far rotational cropping has not been very successful and in this country a system of mixed farming is not generally

practicable in the forest area. To date the results of using fertilizers on annual upland crops have been disappointing, and, in general, applications of superphosphate would only enable a farmer to cultivate his farm under the "shifting cultivation" system for one or two years longer than the present period of one or two years.

189. Two approaches to the problem of maintaining the fertility of upland soils are being investigated. First, experiments are being carried out to see if other plant nutrients, such as magnesium and various trace elements, are deficient. Preliminary pot tests begun in previous years were continued in 1954 and confirmatory experiments were carried out in the field. Secondly, a series of mixed cropping experiments has been started. It is the usual native practice to grow mixed crops—a pure crop, other than swamp rice, is difficult to find. This system adds to the labour of weeding and harvesting but has its benefits. The experiments described are attempts to systematise mixed cropping to obtain some of the benefits of rotational cropping and to indicate some of the results of these approaches.

190. *Pot Experiments—Njala Soils, Potash and Phosphate on Groundnuts.*—On fertilizer demonstration plots at Njala there have been indications that potash may be important in groundnut nutrition. A factorial experiment was therefore laid down to test the effects of four different levels of application of both superphosphate and sulphate of potash. To eliminate variability as much as possible there were six replications with pots in blocks of four, partially confounding the effects of the PK interaction. Plant experiments in pots are most conveniently done in the dry season and to simplify watering the pots were placed on tables within the range of the station's overhead irrigation system. They were watered with the equivalent of 1" of rain every two days. Two Kono groundnuts were planted in each pot. Growth was rapid and effects of fertilizers were noticed after three weeks of growth, when the higher levels of each fertilizer (3 cwts./acre) had produced much larger plants. Flowering was retarded by sulphate of potash but increased by 3 cwts./acre superphosphate.

Mean Number of Flowers Produced per Plant after 6 Weeks Growth

<i>Treatment</i>		<i>Superphosphate Cwt./Acre</i>				
		0	1	2	3	<i>Total</i>
Sulphate of Potash Cwt./Acre	0	5.1	7.0	5.8	7.3	25.2
	1	5.7	6.6	5.3	9.5	27.1
	2	6.8	4.3	5.7	4.9	21.7
	3	5.3	4.6	5.1	4.3	19.3
Total		22.9	22.5	21.9	26.0	93.3

The effect of sulphate of potash was highly significant for a linear regression. It was noticed however that sulphate of potash only retarded flowering and did not reduce the total number of flowers produced:—

Total Number of Flowers Produced per Plant

<i>Treatment</i>		<i>Superphosphate Cwt./Acre</i>				
		0	1	2	3	<i>Total</i>
Sulphate of Potash Cwt./Acre	0	8.2	10.9	9.0	12.4	40.5
	1	9.7	9.7	11.9	14.7	46.0
	2	10.2	9.2	9.8	11.0	40.2
	3	9.1	7.1	11.3	11.3	38.8
Total		37.2	36.9	42.0	49.4	165.5

191. After seven weeks of growth leaf samples were taken from each plant. It was found that the leaf weight increased linearly with increasing dressing of both fertilizers but that superphosphate had the greater effect. The leaves were macerated and the extract analysed for phosphorus, magnesium and iron. Additions of superphosphate made no difference to extractable magnesium in the leaves but increasing dressings of superphosphate reduced the extractable iron by 25 per cent. Sulphate of potash also reduced the iron content. At harvest, which was slightly early, it was found that any level of superphosphate increased the yield by about the same amount, but sulphate of potash had no significant effect as indicated in the following table:—

Weights of Dry Fruits per Plant in Gms.

<i>Treatment</i>		<i>Superphosphate Cwt./Acre</i>				
		0	1	2	3	<i>Total</i>
Sulphate of Potash Cwt./Acre	0	1.3	1.9	1.6	2.2	7.0
	1	1.3	1.9	2.2	1.7	7.1
	2	1.3	1.7	1.9	1.8	6.7
	3	1.5	1.7	1.5	1.8	6.5
Total		5.4	7.2	7.2	7.5	27.3

Thus it appears that, in Njala soil, potassic fertilizers improve general growth but have little effect on the yield, whilst superphosphate improves both growth and yield.

192. *Pot Experiments—Njala Soils. Trace Elements and Lime on Groundnuts.*—An experiment was laid down under similar conditions to the one above to test again the effect of trace elements and lime on groundnuts in Njala soils. The layout in this case was a 2^4 experiment with 6 replications with the 4 treatment interactions confounded completely. The treatments were:

- | | |
|--|-------------------------|
| (1) Hydrated lime equivalent to 1 ton/acre at planting | |
| (2) Borax spray of 10 mls. 5% solution | |
| (3) Manganese sulphate spray of 10 mls. 5% solution | } Applied after 4 weeks |
| (4) Ammonium molybdate spray of 10 mls. 5% solution | |

Results indicated that liming retarded flowering but had little effect on the total number of flowers. Borax had no effect on the number of flowers, whilst manganese sulphate greatly increased and ammonium molybdate reduced it. Tissue extracts were made as in the previous experiment at the same period of growth. More positive results were obtained in this case. Both lime and ammonium molybdate increased the extractable phosphorus, borax increased the magnesium content, as did lime when in the presence of borax, and a combination of lime and ammonium molybdate greatly increased the content of iron. Ammonium molybdate reduced the iron content. At harvest it was found that lime increased the number and weight of kernels whilst borax decreased them by nearly 50 per cent. This effect of lime was indicated in a pot experiment carried out during the early dry season and mentioned in the 1953 Annual Report.

193. *Pot Experiments—Kasanko Soils, Various Fertilizers on Rice.*—A pot experiment was laid down to test the response to fertilizers of rice on Kasanko soils. It was not possible to grow the rice to maturity so that the results are of limited value only. Nevertheless, it was shown that phosphate increased both vegetative growth and the number of tillers. Sulphate of ammonia also increased tillering, but did not increase vegetative growth except in the presence of sulphate of potash or lime. In consequence, trials using sulphate of ammonia are to be initiated at Kasanko.

194. *Field Experiments on Groundnuts with Trace Elements—Njala.*—A 2^8 factorial experiment was laid down in 8 blocks with 1 replication. The treatments were:

(1) Superphosphate	..	..	..	..	2 cwt./acre
(2) Sulphate of potash	..	..	..	..	2 cwt./acre
(3) Hydrated lime	..	..	..	..	30 cwt./acre
(4) Magnesium sulphate	..	..	..	..	2 cwt./acre
(5) Manganese sulphate	..	..	..	..	25 lb./acre
(6) Sodium borate	..	..	..	..	25 lb./acre
(7) Copper sulphate	..	..	..	..	25 lb./acre
(8) Sodium molybdate	..	..	..	..	25 lb./acre

Unfortunately copper sulphate did not arrive in time and it was too late to modify the design. Plots were 24 feet by 6 feet with two-foot wide discards between blocks. After very thorough cultivation during the dry season the macro-nutrients were applied on 13th May and planting took place immediately, using undecorticated nuts. Other nutrients were broadcast on 10th June. Germination was poor and after two weeks the mean germination was 28 per cent with a maximum of 40 per cent and minimum of 14 per cent. Growth scores were made at regular intervals during growth and the most remarkable feature was the response to sulphate of potash. Superphosphate and lime also gave significant responses but they had a very marked negative interaction. Manganese appeared to increase growth later in the season and there was a very strong positive interaction between potash, manganese and magnesium. Although phosphate, potash, magnesium and manganese produced the greatest top growth, at harvest the emphasis was different: lime and magnesium gave the best responses combined with superphosphate and sulphate of potash.

195. It is possible now to suggest that, on Njala soil, to give the best yield of groundnuts superphosphate, sulphate of potash, lime and magnesium sulphate should be applied. Manganese sulphate may also be beneficial. The optimum levels of application are not yet known but at the levels applied in the experiment yields were high.

196. *Field Experiments on Groundnuts with Trace Elements—Malal (Lophira Bush Area).*—A different layout was used for this experiment as information was also required on the optimum rate of application for superphosphate. The basis was a 2^4 factorial experiment with 4 replications, each of 2 plots. The treatments were:

(1) Calcium nitrate	..	..	..	..	2 cwt./acre
(2) Sodium molybdate	..	..	..	..	15 lb./acre
(3) Manganese sulphate	..	..	..	..	40 lb./acre
(4) Sodium borate	..	..	..	..	40 lb./acre

Each plot of the experiment was split into four sub-plots to test the effects of four levels of superphosphate: 0, 2, 4 and 8 cwts/acre.

197. After the usual cultivation the superphosphate was applied on 3rd May, and undecorticated Kono groundnuts planted immediately afterwards. As at Njala germination was poor, averaging 45 per cent. Replacements were made as required and on 26th May the other fertilizers were broadcast. Plants were taken from each plot for analysis on 26th May, 12th June and 2nd July. For analysis the plant was cut at the hypocotyl and only the top used. This meant that later in the season the nuts were included in the analysis. The weight of dry matter in the plant was determined and an analysis was made by a dry ashing procedure. Phosphorus, manganese and iron were determined in all samples. In the last group calcium was determined also.

198. Superphosphate was the only fertilizer which affected the dry matter, and after the first few weeks the increase in dry matter was directly proportional to the quantity applied.

199. The phosphorus content of the plants increased throughout the season but 90 per cent of the uptake was within the first four weeks. It is therefore essential to apply this fertilizer at planting time rather than as a top dressing.

200. The manganese analyses were variable and had a very high standard error. Only calcium nitrate significantly increased the uptake of manganese. The application of manganese sulphate had no effect. The manganese content of plants reached a maximum around 12th June. The decrease after this may be due to leaf fall.

201. Superphosphate dressings greatly decreased the iron content of the plant, and this probably explained the much paler colour of the crop after this fertilizer had been applied. When manganese was applied it increased the iron content considerably and no chlorosis was noticed on treated plots even with high levels of superphosphate. Generally the iron content reached a maximum after six weeks growth.

202. Only superphosphate had any effect on the calcium content of the plants. The effect was positive and linear.

203. Observations during growth showed a severe but patchy attack of "rosette" disease which bore no relation to the treatments applied. This probably accounted for the very high standard error at harvest. Superphosphate was the only treatment which improved yields and increased the nut/shell ratio:

Yield of Groundnuts at Malal

				<i>Superphosphate Cwt./Acre</i>			
				0	2	4	8
Yield lb./acre (shelled)	..	..		152	217	190	215
Nut/Shell ratio	..	..	..	1.02	1.07	1.16	1.09

This experiment did not confirm the results obtained in pot tests and needs to be repeated before definite conclusions can be drawn on the effect of trace elements on this peculiar type of soil.

204. *Mixed Cropping Experiment.*—This was started in 1952 at Njala and has been continued each succeeding year. Yams are grown on ridges 4 feet apart and about 2 feet 6 inches high after deep cultivation in the dry season. On a one-acre block an experiment was laid out to find the optimum date of planting, the effect of fertilizers, the better of the two yam varieties and the effect of the Nigerian system of capping. There were 48 plots and cassava was planted on the single ridge which came between each plot. Musaia cowpeas were grown on the sides of all the ridges and upland rice in the furrows. The layout was modified in 1953 as it has been shown that early planted yams (1st week in May) gave higher yields than those planted later. Variety, fertilizing and capping treatments were continued. Two cwts. of superphosphate were broadcast in the furrows for the rice but no cowpeas were planted. As no difference was found between varieties in 1952 and 1953 the experiment in 1954 was planted with Chinese yams only, otherwise it was similar to that of 1953. In every one of the three years the experimental error has been very high owing to soil variation.

Both fertilizing and capping have had no significant effect. The actual yields of the various crops from the one-acre block were as follows:—

					<i>Actual Yields from Block 13, Njala Farm, in Lb.</i>			
					<i>Yams</i>	<i>Cassava</i>	<i>Paddy</i>	<i>Beans</i>
1952	..	..	..	..	1,172	7,533	135	10
1953	..	..	..	..	3,346	5,033	120	—
1954	..	..	..	..	1,306	3,255	487	56

Block 13 has been in continuous cultivation since 1928 and by 1951 was giving very poor yields. This system of mixed cropping has given a high yield of valuable food crops and the yields have been fairly well maintained over a period of three years. This experiment is being continued.

SYSTEMATIC BOTANY AND ECOLOGY SECTION

205. Although this section was without staff throughout the year, incidental work was carried out by the staff of the Plant Pathologist's Section.

206. Some re-organisation of the herbarium was done to improve the storage conditions and on the receipt of the "Revised Flora of West Tropical Africa, Vol. I, Part I" the relevant herbarium sheets were altered and re-arranged to correspond with the revised nomenclature and classification.

207. About 160 phanerogamic collections were made and duplicates sent to Kew Herbarium. Several of these have proved to be of particular interest and they include a number of new records for Sierra Leone. Fresh seeds and planting material have also been sent to Kew and a considerable number of requests for seeds and plant material from other countries have been met.

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Director of Agriculture.

DEPARTMENT OF AGRICULTURE,
NJALA, VIA MANO,

